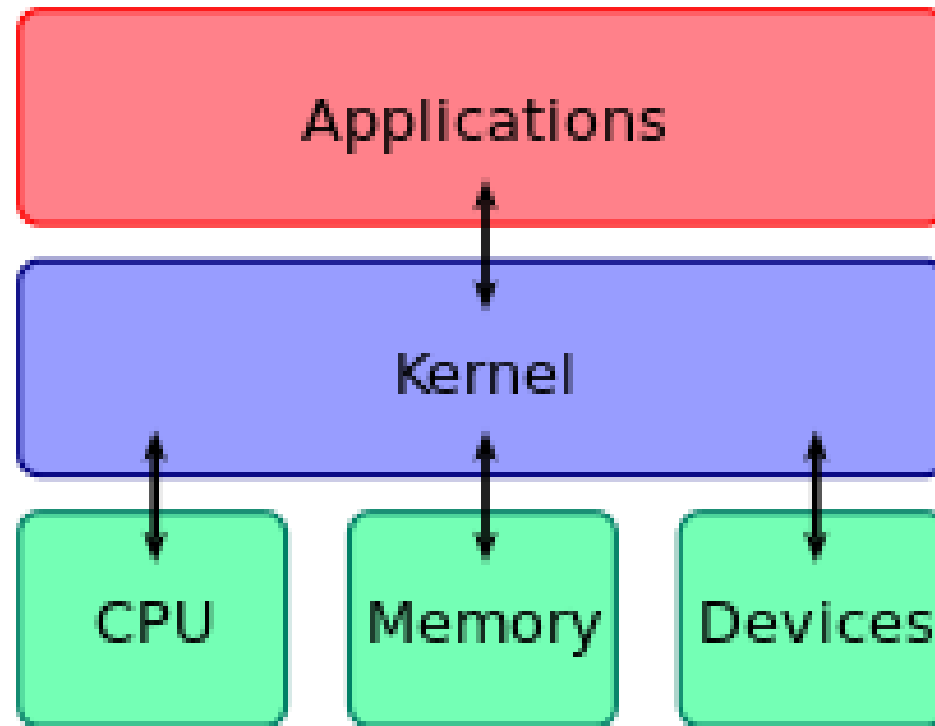


Operating Systems: Managing, Coordinating, and Monitoring Resources

Dr. Jian-Ren Hou

Operating Systems



Operating Systems

- **System software** is the software that runs a computer, including the operating system.
- **Operating system (OS)** is a set of programs that coordinate all the activities of computer or mobile device hardware.
- The operating system and utility programs control the behind-the-scenes operations of a computer or mobile device.

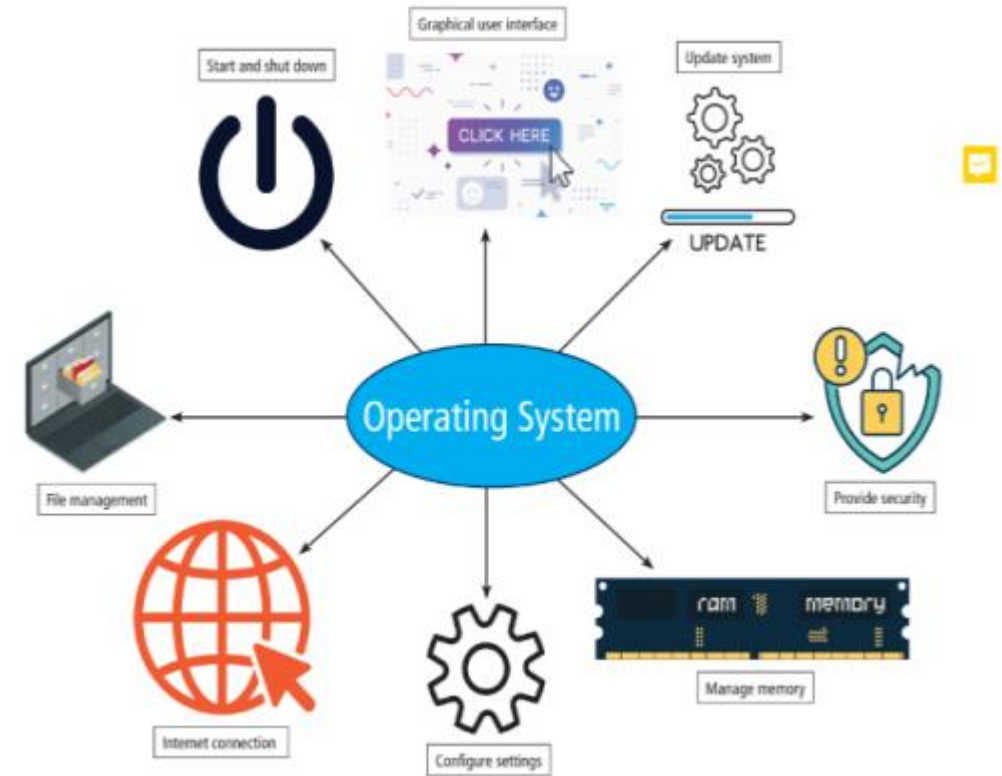


Figure 8-1: Common operating system functions.

Operating Systems

Table 8-1: Programs and apps by category.

Your task	Role of operating system
Start a word processing program and open a document	<ul style="list-style-type: none">• Starts the word processing program• Provides tools for you to open the document file
Add information to the document	<ul style="list-style-type: none">• Manages memory so the computer can run• Saves your unsaved work to temporary storage
Save the document on the hard drive	<ul style="list-style-type: none">• Find the hard drive• Makes sure the hard drive has enough storage space• Saves the document• Stores the location and file name so that you can access the document later

Operating Systems

- A **graphical user interface** (GUI) is a collective term for all the ways you interact with the device.
- A **GUI** controls how you interact with menus, programs and apps, and visual images such as icons, by touching, pointing, tapping, or clicking buttons and other objects to issue commands.
- An **icon** is a small picture that represents a program, file, or hardware device.
- A **button** is a graphic that you click to execute commands you need to work with an app, such as on a toolbar, taskbar, or the ribbon.

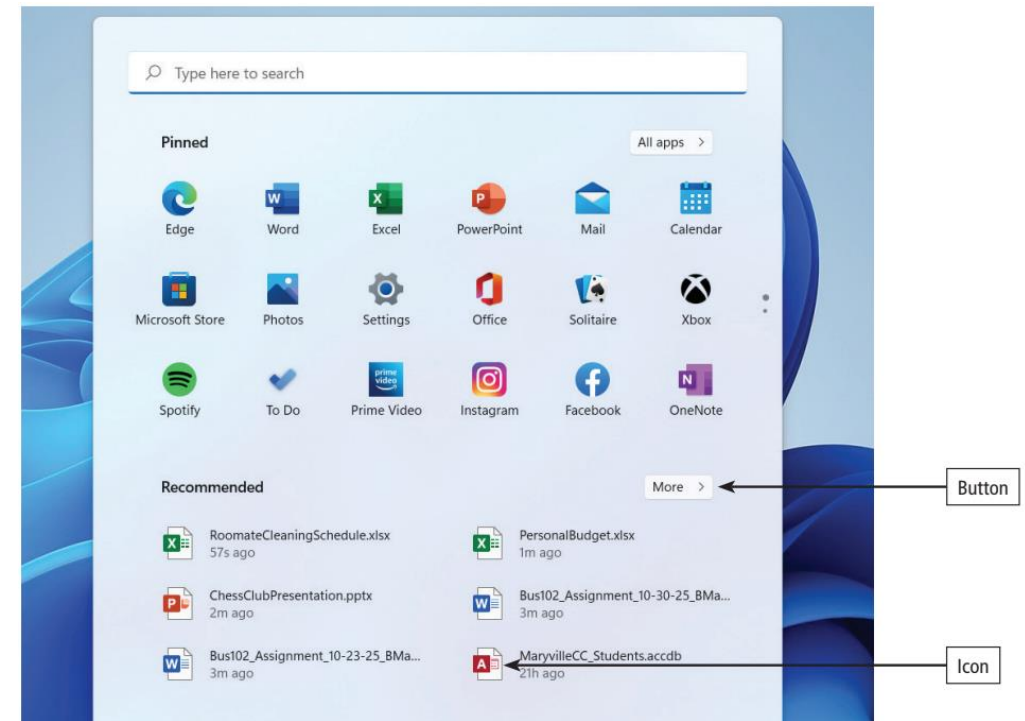


Figure 8-2: Graphical user interface

Operating Systems

Standard operating system functions include:

- Starting and shutting down a computer or device
- Managing programs
- Managing memory
- Coordinating task
- Configuring devices
- Establishing an Internet connection
- Monitoring performance
- Providing file management
- Updating operating system software
- Monitoring security
- Controlling network access

How an Operating System Works

- The **operating system** is the essential software or app on your computer or device.
- The operating system also manages interactions between hardware and software.
- **RAM** is the storage location that temporarily stores open apps and document data while a computer or device is on.
- The more RAM a device has, the more efficiently it runs.
- The operating system can allocate a portion of a storage medium, such as a hard disk, to become virtual memory to function as additional RAM.

How an Operating System Work

- **Virtual memory** allows an operating system to temporarily store data on a storage medium until it can be “swapped” into RAM.
- The technique of swapping items between memory and storage is called **paging**.
- Paging is a time-consuming process.
- Instructions used for processing data can be in the form of a program or app, commands, or user responses.
- The information is processed into **output**.
- For example, a webpage typically combines text and graphics and may include audio and video as well.

How an Operating System Works

- **Input** is any data and instructions entered into the memory of a device.
- Input data and instructions can be provided in many ways, including interacting with your touch screen or using a keyboard.
- Once data is in memory, the computer or device interprets it, and the system software executes instructions to process the data into **information**.
- Instructions used for processing data can be in the form of a program or app, commands, or user responses.
- The information is processed into **output**.



Figure 8-5: Screen displays, printers, and speakers are examples of output devices

How an Operating System Works

- An operating system can be single-tasking or multitasking:
 - ✓ A **single-tasking operating system** allows only one program or app to run at a time.
 - ✓ Most operating systems today are **multitasking**. A **multitasking operating system** allows two or more programs or apps to reside in memory at the same time.

How an Operating System Works

- The one in the **foreground** is the active program, that is, the one you are currently using.
- The other programs running but not in use are in the **background**. The foreground program is typically displayed on the screen, and the background programs are hidden partially or completely behind the foreground program.
- In addition to managing applications, an operating system also manages other processes.
- A **multiuser operating system** enables two or more users to run programs simultaneously.

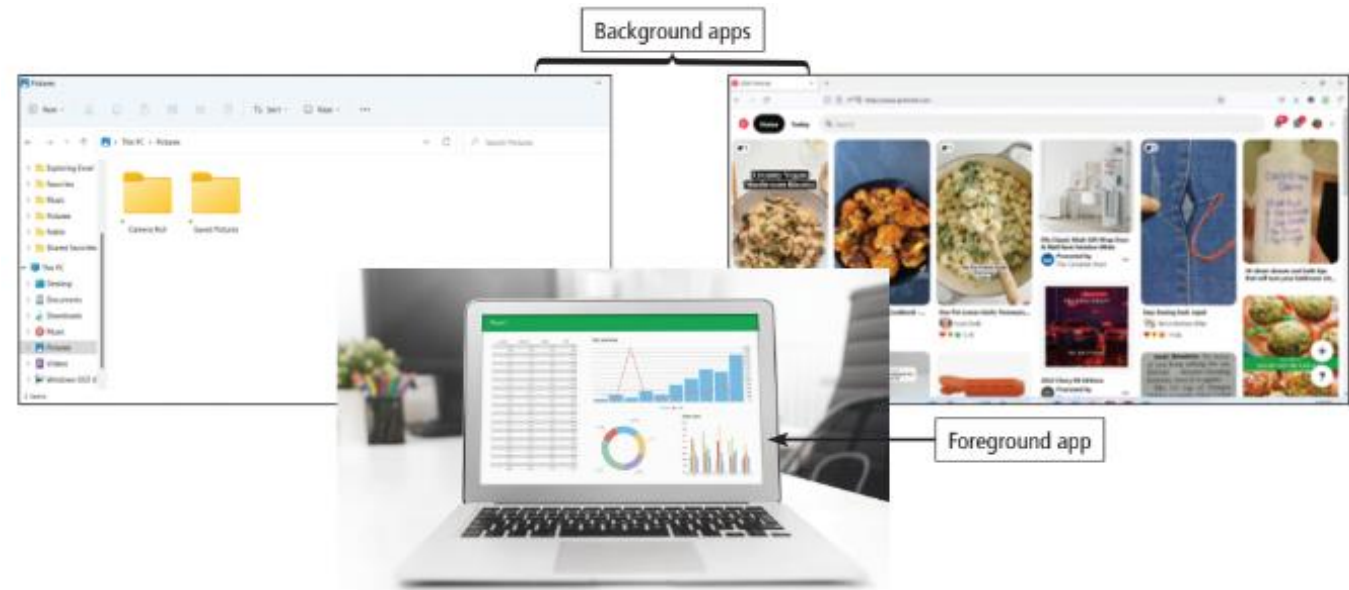


Figure 8-6: The foreground app is on the screen, and the others are in the background

Types of Operating Systems

- **Servers** do not run the same operating system as tablets or laptops because these computers perform different computing tasks.
- A server, by contrast, is always plugged in and generally remains on all the time, which means its operating system would not need a power-saving feature.
- The three basic categories of operating systems on computers and mobile devices are **desktop**, **server**, and **mobile**.
- Operating systems, such as UNIX and Linux that function as both desktop and server operating systems sometimes are called **multipurpose operating systems**.

Types of Operating Systems

Table 8-2: Examples of operating systems by category.

- An operating system installed on a single computer is called a **personal computer (PC) operating system** or a **desktop operating system**.
- Desktop operating systems are also sometimes called **stand-alone operating systems** or **client operating systems**.
- Certain computers and devices run only those operating systems designed specifically for the **computer** or **device**.
- Examples of widely used desktop operating systems include Windows, macOS, UNIX, Linux, and Chrome OS.

Category	Name
Desktop	Windows macOS UNIX Linux Chrome OS
Server	Windows Server macOS Server UNIX Linux
Mobile	Google Android Apple iOS Windows (mobile edition)

Types of Operating Systems

Table 8-3 Examples of Desktop Operating Systems

OS	Used on	Notable features
Microsoft Windows	Desktop computers, laptops, and some tablets	Supports the Cortana virtual assistant, touchscreen input, HoloLens headsets, and built-in apps, such as the Microsoft Edge browser
macOS	Macintosh desktop computers and laptops	Includes the Siri virtual assistant, coordination with Apple mobile devices, and cloud file storage
UNIX	Most computers and devices	Multitasking operating system with many versions as the code is licensed to different developers
Linux	Desktop computers, laptops, and some tablets	Distributed under the terms of a General Public License (GPL), which allows you to copy the OS for your own use, to give to others, or to sell
Chrome OS	Chromebook laptops	Based on Linux, uses the Google Chrome browser as its user interface and primarily runs web apps

Types of Operating Systems

- The term, **PC** (personal computer) is sometimes used to describe a computer that runs the **Windows operating system**.
- Windows includes a browser (Microsoft Edge), a cloud storage service (Microsoft OneDrive), and the Windows store for app purchases.
- **UNIX** (pronounced "you-nix") is a multitasking operating system developed in the early 1970s by scientists at Bell Laboratories.
- **Linux** (pronounced LINN-uks), introduced in 1991, is a popular multitasking UNIX-based operating system that runs on a variety of personal computers, servers, and devices.

Types of Operating Systems

- Linux is available in a variety of forms, known as **distributions**.
- **Chrome OS**, introduced by Google, is a Linux-based operating system designed to work primarily with web apps.
- Apps are available through the Chrome Web Store, and data is stored on Google Drive.
- A specialized laptop that runs Chrome OS is called a **Chromebook**, and a specialized desktop that runs Chrome OS is called a **Chromebox**.
- A **server operating system** is a multiuser operating system because it controls a single, centralized server computer that supports many users on networked computers.

Types of Operating Systems

Table 8-4: Examples of server operating systems.

OS	Used on	Notable features
Windows Server	The server version of Windows	It includes advanced security tools and a set of programs called Internet Information Services that manage web apps and services
macOS Server	Supports all sizes of networks and servers	One unique feature is that it lets authorized users access servers using their iPhones or other Apple devices
UNIX	A multipurpose operating system that can run on a desktop PC or a server	Many web servers, which are Internet computers that store webpages and deliver them to your computer or device, use UNIX because it is a powerful and flexible operating system

Types of Operating Systems

- Smartphones, tablets, and other mobile devices use a mobile operating system.
- A **mobile operating system** has features similar to those of a desktop operating system but is focused on the needs of a mobile user and the capabilities of the device.
- A mobile operating system works especially well with mobile device features, such as touch screens, voice recognition, and Wi-Fi networks.
- Mobile devices are optimized to perform functions common to mobile users.

Table 8-5: Examples of mobile operating systems.

OS	Used on
Android	Developed by Google based on Linux, and designed to be run on many types of smartphones and tablets
iOS	Runs only on Apple devices, including the iPhone, iPad, and iPod; derived from macOS

Types of Operating Systems

- An **operating system** has the same role, whether for a desktop or mobile device.
- It manages operations and provides a **user interface**.
- Operating systems enable you to work with apps and to monitor and maintain the functions of the computer or device.

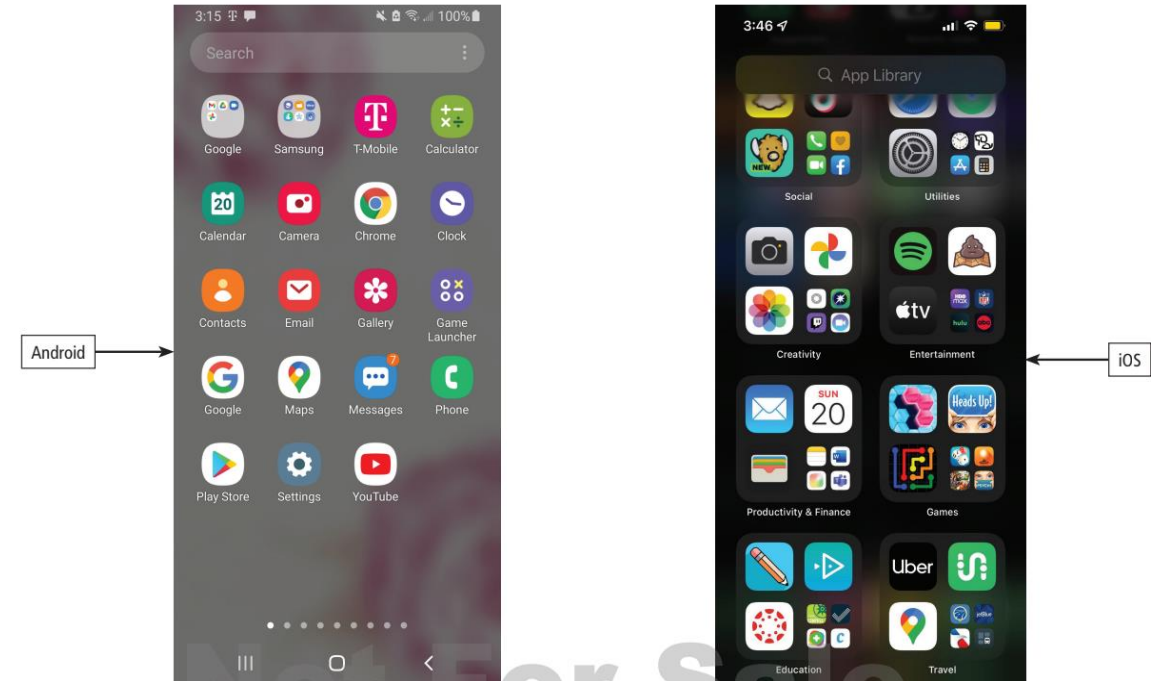


Figure 8-7: Examples of Android and iOS operating systems

Types of Operating Systems

- **Closed-source programs** have standard features and can be customized only by using the operating system's utilities.
- Users can add functionality and sell or give away their versions to others.
- Proponents of open-source programs state that because the code is public, coders can examine, correct, and enhance programs.
- A **device-dependent program** is one that runs only on a specific type or make of computer or mobile device.
- **Proprietary software** is privately owned and limited to a specific vendor or computer or device model.
- **Open-source programs** and **apps** (including operating systems) have no restrictions from the copyright holder regarding modification and redistribution.

Ethics and Issues:

Licensing an Operating System

- As new versions of the operating system are released, users often **upgrade** their existing computers and mobile devices to incorporate features of the new versions.
- The user includes continuity of service (no disruptions because you get cut off from using the software because it is improperly licensed) and security (you have access to the latest updates to know **flaws** or **bugs**).
- An operating system's automatic update feature can be configured to alert users when an update is available or to download and install the update automatically.

Manage Files and Folders

- A **file** is a collection of information stored on your computer, such as a text document, spreadsheet, photo, or song.
- The **file format** determines the type or types of programs and apps that you can use to open and display or work with a file.
- A **file extension** is a three- or four-letter sequence, preceded by a period, at the end of a file name that identifies the file as a particular type of document, such as .docx (Microsoft Word document), or .jpg (a type of graphic file).

Table 8-6: Examples of file extensions.

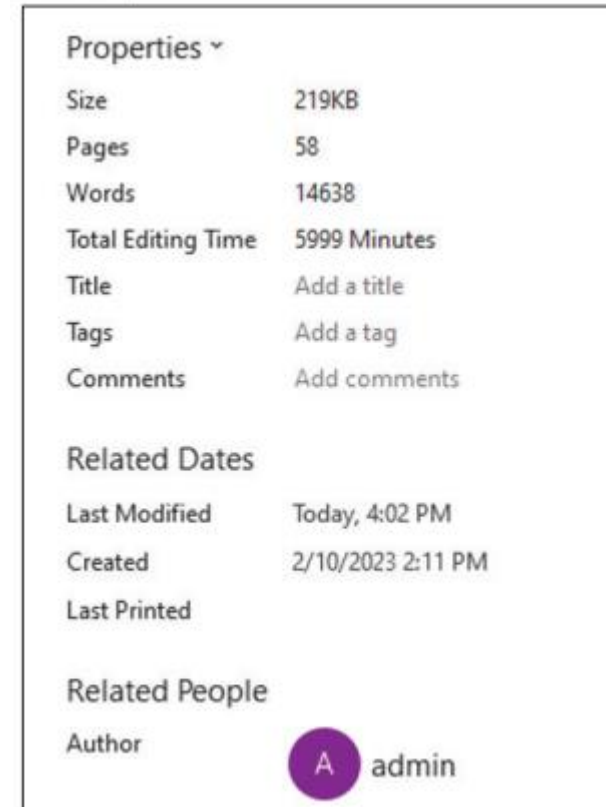
File type	Extensions
Microsoft Office	.docx (Word), .xlsx (Excel), and .pptx (PowerPoint)
Text file	.txt, .rtf
Webpage	.htm or .html, .xml, .asp or .aspx, .css
Graphics	.jpg, .png, .tif

Manage Files and Folders

- You can change or view the properties of a file, compress a file to save storage space, move or rename a **file or folder**, and organize your files.
- Operating systems include many utilities, also called **tools**, that enable you to perform file management tasks.
- Every file has properties, such as its name, type, location, and size.
- File properties also include **metadata**, including the dates when the file was created, modified, and last accessed.

Manage Files and Folders

- The operating system assigns some properties to files, such as type or format, and updates other properties, such as date, size, and location.
- For example, an image might contain information about the dimensions (size) of the image, while a song or media file might include the artist(s) names.




Properties ▾	
Size	219KB
Pages	58
Words	14638
Total Editing Time	5999 Minutes
Title	Add a title
Tags	Add a tag
Comments	Add comments
Related Dates	
Last Modified	Today, 4:02 PM
Created	2/10/2023 2:11 PM
Last Printed	
Related People	
Author	 admin

Figure 8-9: Viewing a file's properties.

Use Operating System Management Utilities

- **Operating systems** provide users with a variety of utilities related to managing their computer and devices and their programs.
- An operating system controls your computer by managing its resources.
- The **operating system** tracks the names and locations of files, as well as empty storage areas where you can save new files.
- To manage **RAM resources**, an operating system keeps track of the apps, processes, and other tasks the system performs.
- You can open your computer or device's version of the task manager to view running programs and see the percentage of RAM being used.
- You can shut down programs and apps in the task manager to free up RAM.

Use Operating System Management Utilities

Table 8-7: Operating system tools.

Tool	Function
File management	Performs functions related to displaying files; organizing files in folders; and copying, renaming, deleting, moving, and sorting files
Search	Attempts to locate files based on specified criteria
Image viewer/Gallery	Displays, copies, and prints the contents of graphics files
Uninstaller	Removes a program or app, as well as any associated entries in the system files
Disk cleanup	Searches for and removes or archives unnecessary files

Use Operating System Management Utilities

Table 8-7: Operating system tools. (continued)

Tool	Function
Lock screen	Causes a display's screen to require the user to sign in again if no keyboard or mouse activity occurs for a specified time
File compression	Shrinks the size of a file(s)
Maintenance	Identifies and fixes operating system problems, detects and repairs drive problems, and includes the capability of improving performance
Backup	Copies selected files or the contents of an entire storage medium to another storage location
Power management	Monitors battery usage

Use Operating System Management Utilities

- Operating systems provide shut down options so that you can exit programs and terminate processes properly.
- Some operating systems have a sleep option to use low power instead of shutting down.
- Sleep stores the current state of open programs and files, saving you time when you resume using your device.
- A common solution for Windows desktop systems is to run a disk cleanup utility, which finds and removes unnecessary files, such as temporary Internet files or files you have marked for deletion.
- Monitoring Performance Operating systems typically include a performance monitor.
- A **performance monitor** is a program that assesses and reports information about various computer resources and devices.
- If a computer is running extremely slowly, for example, the performance monitor may determine that the computer's memory is being used to its maximum.

Secure IT: Securing an Operating System

- **Network administrators**, as well as owners of computers, typically have an administrator account that enables them to access all files and programs, install programs, and specify settings that affect all users on a computer, mobile device, or network.
- Security software must run constantly to protect against new viruses, malware, and spyware attacks.
- Security experts recommend using a **firewall** and configuring it to turn on or off automatically.
- **Automatic updating**: Many people enjoy the convenience offered by allowing these fixes to install automatically instead of continually checking for new files to download.

Secure IT: Securing an Operating System

- **Spyware and malware detection software:** Because sophisticated spyware and malware threats are emerging at an unparalleled rate, comprehensive spyware and malware detection software is crucial to fend off attacks on the computer or device.
- The operating system is generally scheduled to scan and update when the computer is idle, such as in the middle of the night.
- **Permissions** define who can access certain resources and when they can access those resources.
- **User accounts** protect your computer against unauthorized access. A user account includes information such as a username or ID and a password.

How To: Use Virtual Machines

- A **virtual machine** (VM) enables a computer or device to run another operating system in addition to the one installed.
- To run a virtual machine, you need a program or app that is specifically designed to set up and manage virtual machines.
- The virtual machine runs separately on a section of the hard disk called a "**partition.**"

How To: Use Virtual Machines

The following steps describe how to set up a virtual machine:

- Obtain and install an app that creates and runs virtual machines.
- Run the app and select the option to create a new virtual machine.
- Specify the settings for the new virtual machine.
- If necessary, insert the installation media for the operating system you want to run in the virtual machine.
- Run the virtual machine. Follow the steps to install the operating system on the virtual machine.
- When the operating system has finished installing, remove the installation media.
- While the virtual machine is running, if desired, install any apps you want to run.
- When you are finished using the virtual machine, shut down the operating system in the same manner you would shut down your computer.
- Exit the virtual machine software.

Thank You

